



Tension Pneumothorax in Contralateral Lung during Left Video Assisted Thoracoscopic Surgery (VATS) Upper Lobectomy

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Abstract

A Contralateral pneumothorax during surgery is a life-threatening emergency. We experienced a case of intraoperative right tension pneumothorax during a left sided lobectomy in a patient with multiple bullae, the discerning symptoms noted intraoperatively and the management of such an emergency.

Introduction

A 66 year old gentleman was referred to our unit following increasing shortness of breath on the background of previous asbestos exposure, COPD and 50-pack-year smoking history. Interval CT imaging revealed an enlarging speculated lesion in the left upper lobe. A PET scan confirmed a hypermetabolic 19 mm subpleural lesion with no evidence of metastasis.

Procedure

A standard 3-port VATS procedure was performed with the utility port placed anteriorly. The lesion was excised as a wedge for a frozen section. It confirmed a non-small cell lung carcinoma and an upper lobectomy performed. The left superior pulmonary vein, truncus anterior and lingular branch of pulmonary artery were sequentially stapled and divided. The oblique fissure was completed using diathermy. The upper lobe bronchus was then divided and stapled.

During reinflation to check for satisfactory left lower lobe ventilation, the patient started desaturating and became hypotensive. Vasoconstrictors were bloused with little response. No end-tidal-CO₂ was noted from the right lung on one lung ventilation. 3M™ Ioban™ incise drapes were used to cover the left thoracotomy and the patient was placed supine.

A needle thoracostomy was performed and a hiss of air confirmed decompression of the tension pneumothorax. His blood pressure and oxygen saturations improved thereafter. Diagnosis was confirmed with CXR and a 28F chest drain was inserted into the right pleural cavity. The VATS procedure was completed with the two further branches of the pulmonary artery to the upper lobe stapled and divided. The lobe was retrieved via endobag. Washout was performed and haemostasis confirmed. A 28F chest drain was placed via the camera port. Two paravertebral catheters were inserted for post-operative analgesia. The remaining ports were closed with Vicryl sutures, subcuticular Monocryl and Liquiband dressing.

Conclusion

Patients with bullous disease are at a higher risk of developing pneumothorax during surgery. Clinical suspicion should dictate prompt immediate management to prevent adverse outcomes.

A pneumothorax is an abnormal collection of air within the pleural space resulting in uncoupling of the lung from the chest wall [1]. This may or may not be accompanied by pain but invariably presents as dyspnoea. They may occur spontaneously after a rupture of congenital bullae or secondary to infection, trauma, malignancy or chronic obstructive pulmonary disease (COPD) [2]. Tension pneumothorax occurs when there is a rapidly expanding collection of air in the pleural space as a result of a one-way valve formed by the area of damaged tissue. Unless this is reversed effectually in time, death may ensue [3]. Most trauma courses illustrate a patient in extremis thereby giving the impression of straight-forward diagnosis that is reversed on needle thoracostomy but this may not be the case in real life [4]. The literature describes many case reports whereby the

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Table 1: COVER ABCD-A SWIFT CHECK.

C	Circulation, Capnograph, and Colour (saturation)
O	Oxygen supply and Oxygen analyser
V	Ventilation (intubated patient) (<i>include catheter mount and filter check</i>) and Vaporisers (<i>include analysers</i>)
E	Endotracheal tube - <i>Check position, orientation and patency. Always exclude endobronchial intubation. Palpation of the cuff above the sternal notch while squeezing the pilot balloon will confirm its position and slight withdrawal may also resolve desaturation. Patency: ventilate the tube directly (remove circuit, filter, connections) with a separate system. The tip of the tube may have moved, the lumen becomes obstructed or the cuff herniated into the lumen or over the end of the tube. If there is any suspicion of regurgitation, aspiration or obstruction of a tube, perform direct laryngoscopy, suck out the pharynx, adjust the tube's position, consider adjusting the cuff and pass a suction catheter through the tube. Don't forget swabs or throat packs.</i>
R	Review monitors and Review equipment
A	Airway (with face or laryngeal mask)
B	Breathing (with spontaneous ventilation)
C	Circulation (in more detail than above)
D	Drugs (consider all given or not given)
A	Be Aware of Air and Allergy
SWIFT CHECK	Of patient, surgeon, process and responses.

Source: Runciman WB, Kluger MT, Morris RW. Crisis management during anaesthesia: the development of an anaesthetic crisis management manual. *Qual Saf Health Care.* 2005; 14:e1

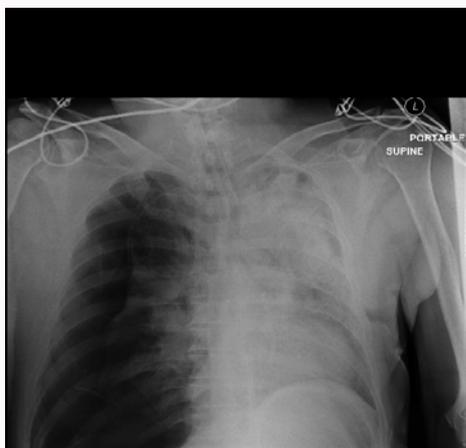


Figure 1: Tension Pneumothorax confirmed on CXR.

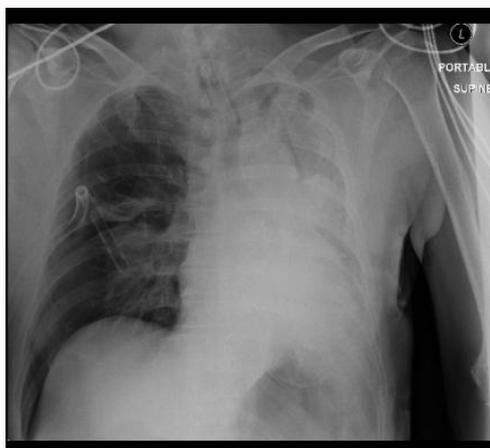


Figure 2: Postoperative CXR with right ICD in place.

'classic' signs of tension pneumothorax were absent thereby resulting in missed initial diagnosis. In a trauma centre in London, tension pneumothorax was confirmed in 5.4% of trauma patients by a hiss of air on needle decompression. Of note, 64% of the patients were ventilated [5]. We present a similar case in a patient undergoing a left sided video assisted thoracoscopic lung resection who developed a contralateral tension pneumothorax while undergoing single lung ventilation.

Case Presentation

Introduction

A 66 year old gentleman was referred to our Cardiothoracic Unit following complaints of increasing shortness of breath on the background of previous asbestos exposure. Other relevant history includes being an ex-smoker with a 50 pack year history and hypothyroidism. He had no noticeable weight loss or haemoptysis. A chest radiograph (CXR) revealed irregular speculated opacity in the left mid zone overlying the anterior aspect of the third rib. A subsequent CT scan of the thorax, abdomen and pelvis revealed the speculated 11mm lesion to be a possible post inflammatory scarring/rounded atelectasis or early bronchial carcinoma on the background of bilateral bullous disease.

A repeat scan done 3 months later revealed an enlarging lesion that measured 12 x 12 x 12 mm with the presence of an enlarged hilar node that was not previously noted. A full body PET scan revealed a hypermetabolic 19 mm subpleural speculate lesion within the left lung's upper lobe in keeping with malignancy with no evidence of metastasis and was suitable for resection. His MRC dyspnea grade was 2 and performance status was 1. He was able to walk approximately 300-400 yards before becoming short of breath and mobilised up and down 2 flights of stairs daily with no limitations. His FEV1 was 86% of the predicted. He was listed for a VATS lobectomy.

Procedure

His preoperative period was uneventful. General anesthesia was induced. The patient was intubated with a left-sided 35F double-lumen tube (DLT) without difficulty and was placed in a right lateral decubitus position. A standard 3 port VATS procedure was performed with the utility port placed anteriorly. The lesion was noted on insertion of the thoracoscope and excised as a wedge using a tri-stapler and sent for a frozen section. The preliminary report was in keeping with non-small cell lung carcinoma and thus a left upper lobectomy was carried out.

The left superior pulmonary vein was dissected and then stapled



Figure 3: CXR at time of discharge from the hospital.



Figure 4: CXR at 6 weeks postoperatively.

and divided. The truncus anterior and lingular branch of the pulmonary artery were stapled and divided followed by completion of the oblique fissure anteriorly using electrocautery. The left upper lobe bronchus was finally divided using the stapler. During reinflation of the lung to check for satisfactory Left Lower Lobe ventilation, the patient started desaturating despite an expanding lower lobe. He was noted to be hypotensive as well. A bolus of vasoconstrictors was administered by the anaesthetist with little response. No end tidal CO_2 was noted in the right lung on one lung ventilation.

The position of the endotracheal tube was confirmed by flexible bronchoscopy and was satisfactory.

A clinical diagnosis of potential right tension pneumothorax was made. 3M™ Ioban™ incise drapes were used to cover the left thoracotomy and the patient was placed on his back.

A 14 G Cannula was inserted in the 3rd intercostal space in the mid-clavicular line and a hiss of air confirmed decompression of the tension pneumothorax. His blood pressure and Oxygen saturations improved thereafter. The diagnosis was confirmed with a CXR and a 28 F chest drain was inserted into the right pleural cavity. The patient was then repositioned on his side and the VATS procedure was continued. The two further branches of the pulmonary artery to the upper lobe; each one was stapled and divided using tri-stapler and vascular staples. The remaining very small part of the oblique fissure posteriorly was completed with blunt dissection. The lobe was then removed using an Endocatch bag. Washout was performed and haemostasis checked and secured. A single 28 French chest drain was left in situ via the camera port. Two paravertebral catheters were inserted for post-operative analgesia. The utility port and the remaining port were closed with Vicryl sutures, subcuticular Monocryl and Liquiband tissue dressing.

Postoperatively, he was required re-intubation and a suction bronchoscopy due to difficulty re-inflating the right lung. Once extubated, he had some epigastric tenderness post operatively treated with IV proton pump inhibitors (PPIs) as per the Hong Kong regime. He was then commenced on oral PPIs once his symptoms settled within 2 days. He was subsequently discharged on post-operative day 7. At follow up in 6 weeks, his wounds had healed well and his CXR revealed some pleural thickening in the left base and reduced lung volume on the operated side but nil else of note.

Discussion

Tension pneumothorax intraoperatively is a rare phenomenon. The Australian Incident Management System (AIMS) recorded that of the 4000 reports sent, 65 mentioned pneumothorax as a potential or actual diagnosis, and in 24, a pneumothorax was confirmed with CXR [6]. The same group developed an algorithm for dealing with such events called **COVER ABCD-A SWIFT CHECK** which is described below (Table 1).

Diagnosis of tension pneumothorax especially in ventilated patients can be challenging. Progression of a simple pneumothorax to a tension pneumothorax is more likely in a ventilated patient and is associated with a higher mortality, quoted at 91% in one series [7].

In a patient with an open thorax, the classic signs of decreased O_2 saturation and increasing difficulty in ventilation and circulatory collapse may be blunted due to the lack of a mediastinal shift and compression; thereby not causing distortion of the great vessels as the one-way valve effect is mitigated by the thoracotomy 2.

Despite this, contralateral tension pneumothorax during thoracotomy is a rare phenomenon. However due to the fragility of emphysematous bullae in our patient, even a small amount of positive pressure ventilation could cause a rupture secondary to barotrauma. Other potential causes include pleural punctures from central line insertion, epidural needle insertion and damage to the bronchus during introduction of the bronchial tube [8].

A review conducted by Leigh-Smith et al. (2000) looked at the causes of tension pneumothorax in ventilated patients from case-reports.

Universal findings in most case reports describing tension pneumothorax in ventilated patients include rapid onset, immediate and progressive decrement in arterial and mixed venous SpO_2 , and immediate reduction in cardiac output with or without blood pressure changes. A high index of suspicion is also needed especially in patients with emphysematous disease bilaterally.

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